

REMARKS

In paragraphs 1 and 2 of the Office Action the prior Restriction Requirement is discussed. Applicant confirms that claims 1-16 were withdrawn in response to the Restriction Requirement. Additionally, Applicant notes that in this Amendment claims 8-13 have been cancelled, comprising one independent claim (claim 8) and totaling six claims. In this Amendment Applicant has added new claims 23-27, and created one independent claim (amended prior dependent claim 21 to be in independent form), and thus adding a total of 5 new claims. Applicant therefore respectfully submits that no further fees for additional claims are required for this Amendment.

In paragraph 3 of the Office Action it is required that a new title be provided. Responsive hereto, Applicant has amended the title as suggested, to read -- A METHOD FOR FABRICATING A MAGNETIC HEAD --.

In paragraphs 4 and 5 of the Office Action claims 17-19 are rejected under 35 U.S.C. 102(b) as being anticipated by Saito et al. (US PAT. 6,153,062), stating:

“Saito et al. teach a process of making a magnetoresistive element comprising steps of: fabricating a plurality of thin film layers to create a read sensor, the read sensor including a first insulation layer (not shown), a pinned layer (3), a pinning layer (4), a spacer layer (2), a free magnetic layer (1) having a midplane thereof, and a cap layer (7); milling the plurality of thin films such that a central sensor region is protected from milling and unprotected outer regions are milled, such that the free magnetic layer is formed with a central portion and outwardly disposed side edge portions as shown in Fig. 1; fabricating a hard bias structure at the outer regions such that the hard bias structure is disposed proximate the side edge portions of the free magnetic layer, the hard bias structure including a seed layer (8) and a hard bias layer (5), and wherein the hard bias layer has a midplane that is disposed at a horizontal level within the magnetic head that is approximately coplanar with the midplane of the free magnetic layer as shown in Fig. 1 (see also col. 11, line 15 to col. 13, line 3).

As per claim 18 the hard bias layer is deposited next to the side edge portions of the free magnetic layer as shown in Fig. 1.

As per claim 19 the hard bias layer has a thickness of 20 nm and the seed layer appears to be thinner than the hard bias layer. Therefore, the thickness of the seed layer is, inherently, less than 20 nm.”

Responsive hereto, Applicant has amended independent claim 17 to add the new limitation that the upper portion of the seed layer is removed prior to the deposition of hard bias material upon the seed layer. This limitation is similar to, although more general than the limitation of claim 20 which indicates that the upper surface of the seed layer has been ion milled. The reference Saito '062 is therefore distinguished from amended independent claim 17 in that Saito '062 fails to teach the removal of an upper portion of the seed layer prior to the deposition of hard bias material thereon. Applicant therefore respectfully submits that independent claim 17 has been amended such that it is no longer anticipated by the teachings of Saito '062.

With regard to dependent claim 18, Applicant submits that this claim is allowable in that it depends from an allowable base claim, independent claim 17.

With regard to claim 19, Applicant has amended the thickness ranges of the seed layer and hard bias layer such that they are no longer anticipated by Saito '062. Additionally, Applicant alternatively urges that claim 19 is allowable in that it depends from an allowable base claim (claim 18 which depends from independent claim 17).

In paragraph 6 of the Office Action claims 17-19 are rejected under 35 U.S.C. 102(e) as being anticipated by Fukui et al. (US 2004/0047087 A1), stating:

“Fukui et al. teach a process of making a magnetoresistive sensor comprising steps of: fabricating a plurality of thin film layers to create a read sensor, the read sensor including a first insulation layer (111-b), a pinned layer (103), a pinning layer (104), a spacer layer (102), a free magnetic layer (01) having a midplane thereof, and a cap layer (105); milling the plurality of thin films such that a central sensor region is protected from milling and unprotected outer regions are milled, which is well-known in the art, such that the free magnetic layer is formed with a central portion and outwardly disposed side edge portions as shown in Fig. 1; fabricating a hard bias structure at the outer regions such that the hard bias structure is disposed proximate the side edge portions of the free magnetic layer, the hard bias structure including a seed layer (106) and a hard bias layer (107), and wherein the hard bias layer has a midplane that is disposed at a horizontal level within the magnetic head that is approximately coplanar with the midplane of the free magnetic layer as shown in Fig. 1 (see also Paragraph [0028] to [0030]).

As per claim 18 the hard bias layer is deposited next to the side edge portions of the free magnetic layer as shown in Fig. 1.

As per claim 19 the seed layer has a thickness of 5 nm, and the hard bias layer has a thickness of 30 nm.”

Responsive hereto, Applicant has amended independent claim 17 (as described above) to add the new limitation that the upper portion of the seed layer is removed prior to the deposition of hard bias material upon the seed layer. This limitation is similar to, although more general than the limitation of claim 20 which indicates that the upper surface of the seed layer has been ion milled. The reference Fukui ‘087 is therefore distinguished from amended claim 17 in that Fukui ‘087 fails to teach the removal of an upper portion of the seed layer prior to the deposition of hard bias material thereon. Applicant therefore respectfully submits that independent claim 17 has been amended such that it is no longer anticipated by the teachings of Fukui ‘087.

With regard to dependent claim 18, Applicant submits that this claim is allowable in that it depends from an allowable base claim, independent claim 17.

With regard to claim 19, Applicant has amended the thickness ranges of the seed layer and hard bias layer such that they are no longer anticipated by Fukui ‘087. Additionally, Applicant alternatively urges that claim 19 is allowable in that it depends from an allowable base claim (claim 18 which depends from independent claim 17).

In paragraphs 7 and 8 of the Office Action claims 17-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gibbons et al. (US PAT. 6,421,212), stating:

“Gibbons et al. teach a process of making a magnetoresistive element comprising steps of: fabricating a plurality of thin film layers to create a read sensor (20), the read sensor including a first insulation layer (10) with a known multilayered sensor layer including a cap layer (col. 5, lines 37-42), which the free layer could have a midplane thereof; milling the plurality of thin films such that a central sensor region is protected from milling and unprotected outer regions are milled, such that the free magnetic layer is formed with a central portion and outwardly disposed side edge portions as shown in Fig. 3; fabricating a hard bias structure at the outer regions such that the hard bias structure is disposed proximate the side edge portions of the free magnetic layer, the hard bias structure including a seed layer (15) and a hard bias layer (150), and wherein the hard bias layer has a midplane that is disposed at a horizontal level within the magnetic head that is approximately coplanar with the midplane of the read sensor (equivalent with the free magnetic layer) as shown in Fig. 6 (see also col. 5, line 23 to col. 8, line 52).

As per claim 18 the hard bias layer is deposited next to the side edge portions of the free magnetic layer as shown in Fig. 6.

As per claims 19 and 22 Gibbons et al. also teach that filler layer (equivalent with a seed layer) has a typical thickness about 1000-4000 angstroms. At the time the invention was made, it would have been an obvious matter of design choice to a person of ordinary skill in the art to apply the thickness of the seed layer and the hard bias layer as recited in the claimed invention because Applicant has not disclosed that the thickness of the seed layer and the hard bias layer as recited in the claimed invention provides an advantage, is used for a particular purpose, or solves a stated problem. One of ordinary skill in the art, furthermore, would have expected Applicant's invention to perform equally well with Gibbons et al. Therefore, it would have been an obvious matter of design choice to modify the thickness of the seed layer and the hard bias layer of Gibbons et al to obtain the invention as specified in claims 19 and 22.

As per claim 20 the seed layer has an upper surface that has been ion milled as shown in Fig. 5.

As per claim 21 the seed layer is comprised of a first seed layer portion and a second seed layer portion, where the first seed layer portion (115) has an ion milled upper surface upon which the second seed layer portion (15) is disposed as shown in Figs. 4 and 5.”

Responsive hereto, Applicant asserts that claims 17-22 recite subject matter that is neither taught by nor obvious from Gibbons '212. As can be seen in Gibbons, column 5, lines 61 through column 6, line 10, and as depicted in Figs. 3-5 Gibbons teaches the creation of a cavity 10b in the G1 layer, followed by the deposition of an insulation fill layer 115 comprised of a material such as Al_2O_3 . Thereafter, the fill layer material is ion milled, and thereafter the hard bias structure is fabricated upon the ion milled fill layer material. Gibbons teaches that following the fill layer milling, the upper surface of the fill layer 15 is preferably at or below the original G1 layer surface (column 6, lines 33-37, Fig. 5). Gibbons purposefully mills the cavities in 10b into the G1 layer to achieve vertical sidewalls for the MR sensor. After the milling of the fill layer 15, Gibbons teaches the creation of a typical, prior art hard bias structure, consisting of a Cr seed layer and hard bias layer CoPtCr upon the fill material 15 (column 6, lines 47-49).

Significantly, there is no teaching in Gibbons of the advantage of milling the seed layer prior to the deposition of the hard bias material. In the present invention, the milling of the seed layer is done to remove seed layer material from the sides of the MR sensor prior to depositing

the hard bias material. This is done in the present invention to place hard bias material at the sides of the MR layer, without any intervening seed layer material. In the Gibbons device, the seed layer of the hard bias structure is deposited upon the sidewalls of the MR sensor prior to the deposition of the hard bias material. This is the very unwanted seed layer deposition that the present invention corrects. Regarding amended independent claim 17, Applicant submits that Gibbons neither teaches nor renders obvious Applicant's claimed invention including the limitation of removing seed layer material prior to the deposition of hard bias material in the creation of the hard bias structure.

With regard to dependent claim 18, in the Gibbons device the seed layer material will be deposited next to side edge portions of the free magnetic layer, whereas claim 18 calls for hard bias material to be deposited next to the side edge of the MR sensor layers. Applicant therefore submits that claim 18 is not obvious from the teachings of Gibbons. Alternatively, Applicant urges that claim 18 is allowable in that it depends from allowable independent base claim 17.

Regarding claim 19, it calls for a seed layer having a thickness of approximately 25-30 nm. In comparison therewith the fill layer of Gibbons (because this ground rejection compares Gibbon's fill layer with Applicant's seed layer) has a typical thickness of about 1,000-4,000 Å, as stated in the rejection. This thickness is approximately 3 to 10 times the 25-30 nm thickness of Applicant's seed layer. Applicant therefore respectfully submits that dependent claim 19 recites subject matter that is not obvious from the cited prior art, and alternatively, that dependent claim 19 is allowable in that it depends from an allowable base claim.

Regarding dependent claim 20 it is rejected through an analogy that Gibbon's fill layer is analogous to Applicant's seed layer. However, as described above, the Gibbons device does also include a seed layer, and there is no milling or material removal step that Gibbons teaches with regard to its seed layer. Applicant therefore respectfully submits that claim 20 recites subject matter that is not obvious from the cited prior art, and alternatively, that dependent claim 20 is allowable in that it depends from an allowable base claim.

Regarding amended independent claim 21, it sets forth the limitations of two seed layers being deposited beneath the hard bias material, where a relatively thick first seed layer is deposited, the upper surface thereof is removed and a second seed layer is deposited thereon. As described above, Gibbons teaches the fabrication of straight sidewalls of the MR sensor by

milling sufficiently to create a cavity 10b within the G1 insulation layer. Thereafter, Gibbons teaches filling the cavity with additional insulation material and milling the fill material to remove it from the sidewalls of the MR sensor. Thereafter, Gibbons deposits a standard hard bias structure including a seed layer followed by hard bias material. Gibbons does not teach the utilization of two seed layers where material is removed from the upper surface of the first seed layer. Applicant therefore respectfully submits that amended independent claim 21 recites subject matter that is not obvious from the cited prior art.

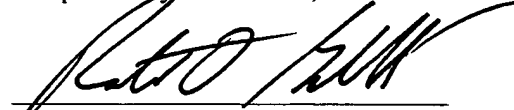
Regarding claim 22, it recites the further limitation that the first seed layer is approximately 20-25 nm thick. As described above, if Gibbons fill layer is analogized to Applicant's first seed layer, the thickness (1,000-4,000 Å) of the fill layer (as set forth in the rejection) is generally three to ten times greater than that of Applicant's seed layer. Applicant therefore respectfully submits that dependent claim 22 recites patentable subject matter, and alternatively, that dependent claim 22 is allowable in that it depends from an allowable base claim, independent claim 21.

Regarding new claims 23-27, each of these new claims recite further limitations regarding the thicknesses of the seed layers and/or the material that comprises the seed layers. Applicant submits that these claims recite limitations that are not taught by the prior art, and alternatively, that the new claims are allowable in that they depend from an allowable base claim.

Having responded to all of the paragraphs of the Office Action, and having amended the claims accordingly, Applicant respectfully submits that the Application is now in condition for allowance. Applicant therefore respectfully requests that a Notice of Allowance be forthcoming

at the Examiner's earliest opportunity. Should the Examiner have any questions or comments with regard to this amendment, a telephonic conference at the number set forth below is respectfully requested.

Respectfully submitted,



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Dated: May 25, 2006

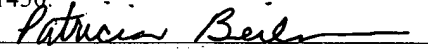
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I hereby certify that this paper (along with any referred to as being attached or enclosed) is being deposited on May 25, 2006 with the U.S. Postal Service as first class mail in an envelope addressed to: MS Amendment, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

Date: May 25, 2006


Patricia Beilman